

# AVL: Unlocking Australia's vanadium advantage

February 2025

ASX:AVL

## Compliance & Cautionary Forward-looking Statements

The views expressed in this Presentation contain information derived from publicly available sources that have not been independently verified. No representation or warranty is made as to the accuracy, completeness or reliability of the information.

### Forward Looking Statements

This Presentation may contain certain forward-looking statements with respect to matters including but not limited to the financial condition, results of operations and business of AVL and certain of the plans and objectives of AVL with respect to these items. These forward-looking statements are not historical facts but rather are based on AVL's current expectations, estimates and projections about the industry in which AVL operates and its beliefs and assumptions.

Words such as "anticipates," "considers," "expects," "intends," "plans," "believes," "seeks," "estimates," "guidance" and similar expressions are intended to identify forward looking statements and should be considered an at-risk statement. Such statements are subject to certain risks and uncertainties, particularly those risks or uncertainties inherent in the industry in which AVL operates.




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and government regulation and judicial outcomes. For more detailed discussion of such risks and other factors, see the Company's Annual Reports, as well as the Company's other filings.

AVL cautions shareholders and prospective shareholders not to place undue reliance on these forward-looking statements, which relate only to events as of the date on which the statements are made.

**ASX Listing Rule 5.23** The information in this announcement relating to mineral resource estimates for the Australian Vanadium Project is extracted from the announcement entitled '39% Increase in High Grade Measured and Indicated Mineral Resource' released to the ASX on 7 May 2024. The relevant announcement is available on the Company's website [www.avl.au](http://www.avl.au). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcements, and that all material assumptions and technical parameters underpinning the estimates in the original market announcement continue to apply and have not materially changed. The Company confirms that the form and context in which the competent person's findings are presented have not been materially modified from the original market announcements.

## Vertically integrated to generate value across the supply chain

	<b>Downstream</b>	<b>Midstream</b>	<b>Upstream</b>
			
	<b>Utility scale vanadium flow batteries</b>	<b>Vanadium electrolyte manufacture</b>	<b>Vanadium mining and processing</b>
<b>AVL Asset</b>	VSUN Energy	Electrolyte manufacturing facility	Australian Vanadium Project
<b>AVL competitive advantage</b>	Commercial VFB BESS projects and the development of Project Lumina positions VSUN Energy as a leader in VFB BESS deployment in Australia <sup>1</sup>	Operational facility. Electrolyte being qualified for utilisation with leading VFB OEMs <sup>2</sup>	High-grade project in Tier-1 jurisdiction capable of delivering oxides for VFB BESS electrolyte <sup>3</sup>

Notes:

1. Refer ASX announcement 6 November 2024, "Realising AVL's Utility-Scale Vanadium Flow Battery Strategy"
2. Refer ASX announcement 16 September 2024 "Electrolyte Successfully Deployed in VFB for Horizon Power"
3. Refer ASX announcement 7 May 2024, "39% increase in high grade measured and indicated mineral resource"

# AVL: Working to unlock Australia's vanadium advantage in Western Australia

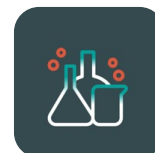


## Downstream



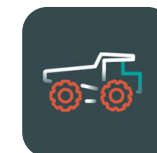
### Utility scale vanadium flow batteries

## Midstream



### Electrolyte manufacture

## Upstream



### Vanadium mining and processing

#### If re-elected WA Labor has pledged

- ✓ Pledged \$150m to support development of 50MW 10 hour (500MWh) vanadium flow battery in Kalgoorlie<sup>1</sup>
- ✓ Net zero royalty on vanadium electrolyte product<sup>2</sup>
- ✓ Royalty of 2.5% on vanadium products excluding electrolyte<sup>2</sup>

#### Why AVL

- ✓ With AVL's vertically integrated vanadium strategy and the work being done on Project Lumina, the Company is well-positioned to pursue opportunities like this proposed Kalgoorlie battery.<sup>3</sup>
- ✓ AVL has the only commercial electrolyte facility in WA and its locally produced electrolyte is installed in VFB for Horizon Power<sup>4</sup>
- ✓ Australian Vanadium Project is a large high-grade deposit located in WA<sup>5</sup>
- ✓ Granted Major Project Status by WA Government<sup>5</sup>
- ✓ Significant EPA approval received<sup>5</sup>

Notes: 1. [www.rogercook.com.au/media/australian-first-battery-project-to-reinforce-kalgoorlie-s-energy-system](http://www.rogercook.com.au/media/australian-first-battery-project-to-reinforce-kalgoorlie-s-energy-system)  
 2. [www.amec.org.au/wp-content/uploads/2025/01/04.-An-important-step-forward-for-Western-Australias-emerging-Vanadium-Industry.pdf](http://www.amec.org.au/wp-content/uploads/2025/01/04.-An-important-step-forward-for-Western-Australias-emerging-Vanadium-Industry.pdf)  
 3. Refer ASX announcement 6 November 2024, "Realising AVL's Utility-Scale Vanadium Flow Battery Strategy"  
 4. Refer ASX announcement 16 September 2024 "Electrolyte Successfully Deployed in VFB for Horizon Power"  
 5. Refer ASX announcement 31 January 2025 "Quarterly activities report\_

# Vanadium: delivering positive economic outcomes for Western Australia



Benefits for Western Australia	Vanadium
1 Growing or improving industrial capability	●
2 Helping industry pursue value-adding opportunities	●
3 Improving economic diversity	●
4 Crowding-in private finance	●
5 Decarbonisation	●
6 Creating secure jobs and a skilled, adaptable workforce	●
7 Boosting supply chain resilience	●
8 Commercialising Australian innovation and technology	●
9 Sustainability and circular economy principles and solutions	●
10 Regional development	●

## The world class Australian Vanadium Project is at the core of our vertical integration strategy

- 

A world class asset located in Western Australia, a Tier-1 mining jurisdiction
- 

Simple open pit mining with standard magnetite concentrator process
- 

Global vanadium MRE of 395.4Mt at 0.77% V<sub>2</sub>O<sub>5</sub> including 104.5Mt at 1.12% V<sub>2</sub>O<sub>5</sub> classified as Measured or Indicated<sup>1</sup>
- 

Optimised Feasibility Study underway, aimed at creating project with superior economics<sup>2</sup>
- 

Current focus on finalising remaining approvals, while securing offtake and funding



Notes:

1. Refer ASX announcement 7 May 2024, "39% increase in high grade measured and indicated mineral resource"
2. Refer ASX announcement 2 July 2024, "Completion of First Phase of Optimised Feasibility Study"

The background features a dark teal globe with a network of white lines and dots overlaid on it, suggesting a global or technological theme. A solid orange vertical bar is positioned on the left side of the slide.

# An Australian VFB industry unlocks demand for vanadium

## A single utility scale VFB BESS unlocks globally significant demand for vanadium

**50MW /  
500MWh  
VFB BESS**

~

**4kt**  
V<sub>2</sub>O<sub>5</sub> demand<sup>1</sup>

~

**c.1.7%**  
Of global V<sub>2</sub>O<sub>5</sub>  
supply<sup>2</sup>

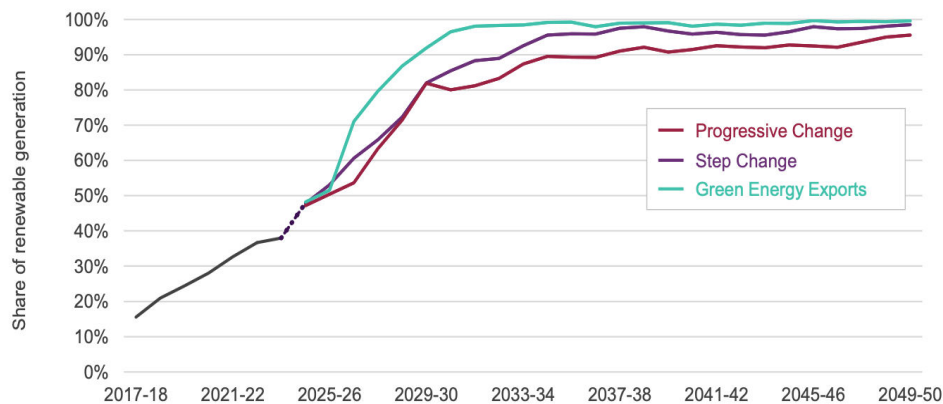
Sources:

1. AVL internal, utility scale VFB BESS
2. TTP Squared, Inc - 2024 global vanadium market size 133,000 metric tonnes vanadium (equivalent to 237kt V<sub>2</sub>O<sub>5</sub>)

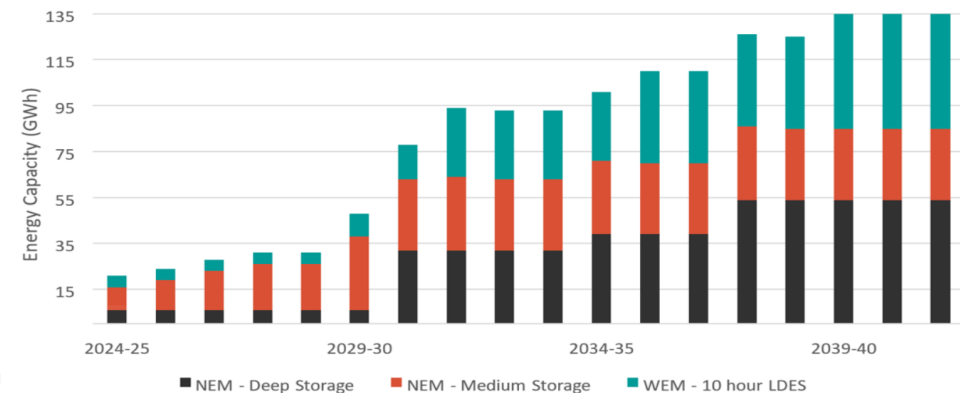


# The NEM cannot meet the forecasted transition away from fossil fuels without rapid growth in longer duration energy storage

Generation from renewable sources – NEM (%)



Deep and medium duration energy storage (excluding large scale pumped hydro)



Renewable energy generation is set to rapidly increase ...

... driving the need for long duration storage to stabilise the grid

Source: Australian Energy Market Operator (AEMO) 2024 Integrated System Plan for the National Electricity Market

Notes:

1. AEMO – Australian Energy Market Operator
2. NEM – National Electricity Market (the electricity market of the eastern and southeastern states of Australia)
3. WEM – Wholesale Electricity Market (the electricity market of Western Australia’s South-West Interconnected System – SWIS)

## Why VFB BESS is best positioned to meet demand for long duration storage

### Zero

Thermal event risk – VFB is a non-flammable technology

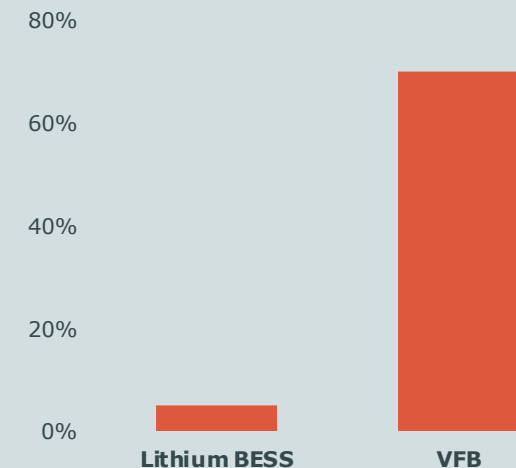
### >99%

VFB commercial end-of-life reuse and recyclability<sup>2</sup>

### Proven

Nearly 20-year history of grid-connected VFB BESS

### AVL targeting a high level of local content to VFB deployment



### Cost

VFB BESS competitive on a LCOS basis to lithium-ion BESS<sup>1</sup>

### 30+

Years VFB BESS asset life

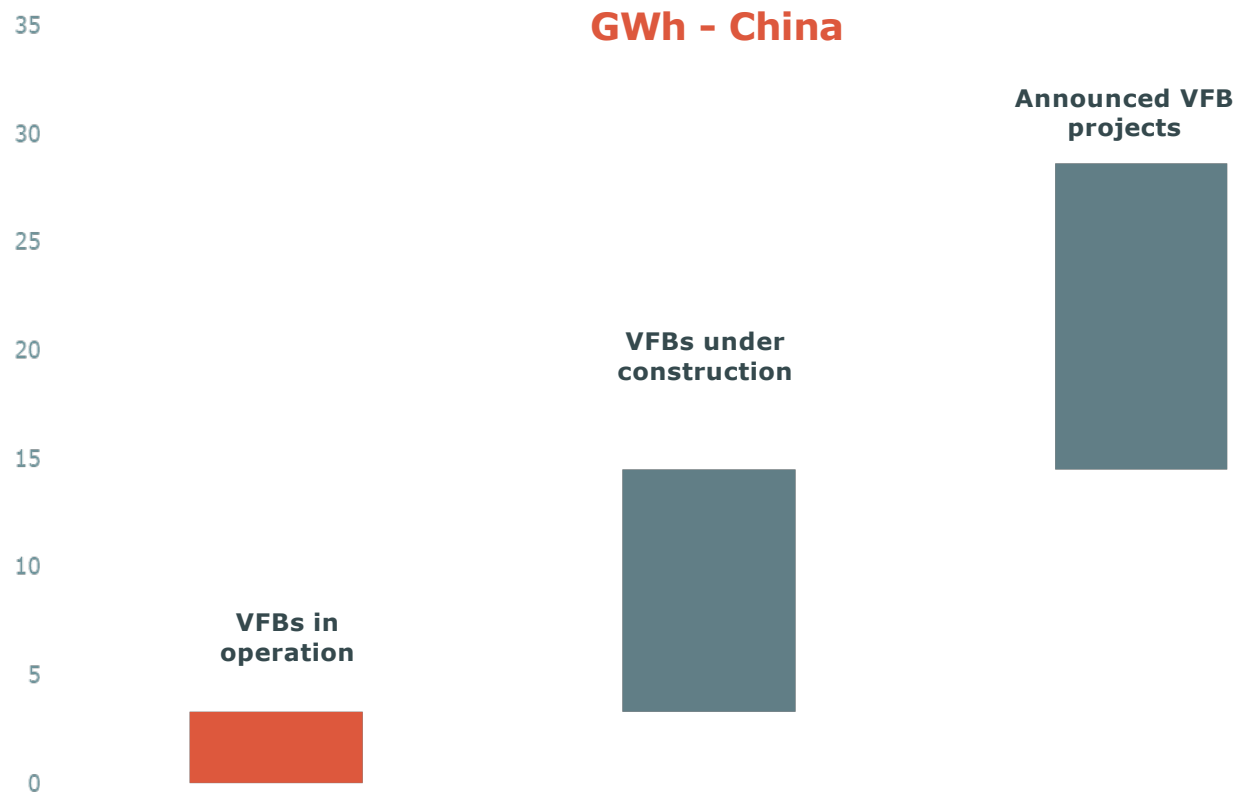
### Australian

VFB technology designed by UNSW and CSIRO in 1970s

Notes:

1. LCOS: Levelised Cost of Storage. See ASX announcement 'Realising AVL's utility scale vanadium flow battery strategy' dated 6 November 2024
2. Sumitomo Electric - [sumitomoelectric.com/products/flow-batteries/features](https://sumitomoelectric.com/products/flow-batteries/features)

# VFB adoption in China is already at GWh scale Australia has all the right ingredients to be a fast follower



**Source:**

<https://vanitec.org/vanadium/map> and China Iron & Steel Research Institute Group (CISRI) VTC Workshop & 23 October 2024

Investor Presentation | February 2025 | ASX:AVL

## Government support drives technology acceptance and scale

### Hornsdale - 2017<sup>1</sup>

- 100MW/129MWh
- World's largest lithium BESS when built in 2017
- \$15m support from SA Government, \$8m from ARENA and CEFC debt underwrote project economics

### Collie - 2023<sup>2</sup>

- 500MW/2000MWh
- Australia's largest Li-BESS in 2023
- Project supported by WA Government's \$2.8bn commitment to renewable energy projects

### Kalgoorlie VFB – ~2027 TBC<sup>3</sup>

- 50MW/500MWh
- If built, will be Australia's largest VFB BESS
- \$150m funding support from WA Labor if re-elected

Sources:

1. [https://en.wikipedia.org/wiki/Hornsdale\\_Power\\_Reserve](https://en.wikipedia.org/wiki/Hornsdale_Power_Reserve)
2. <https://www.wa.gov.au/government/media-statements/Cook-Labor-Government/%241-billion-contracts-awarded-for-Kwinana-and-Collie-big-batteries-20230919>
3. [www.rogercook.com.au/media/australian-first-battery-project-to-reinforce-kalgoorlie-s-energy-system](http://www.rogercook.com.au/media/australian-first-battery-project-to-reinforce-kalgoorlie-s-energy-system)

# Vanadium flow batteries are proven at scale globally, Gigafactory manufacturing capacity expanding



**400MWh**



**700MWh**



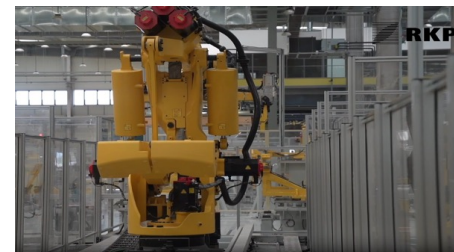
**400MWh**



**400MWh**



**400MWh**



**RKP fully automated  
gigafactory – 1GWh**




## Announced Gigafactories

Date Gigafactory Announced	Capacity (per year)
January 2023	1GWh
February 2023	4GWh
March 2023	1GWh
April 2023	4GWh
September 2023	2GWh
November 2023	1GWh
December 2024	1GWh
March 2024	2GWh
May 2024	1GWh
June 2024	4GWh
October 2024	3GWh
December 2024	2.5GWh
December 2024	2GWh
December 2024	0.5GWh
January 2025	2GWh
January 2025	4GWh
<b>Total</b>	<b>35GWh</b>

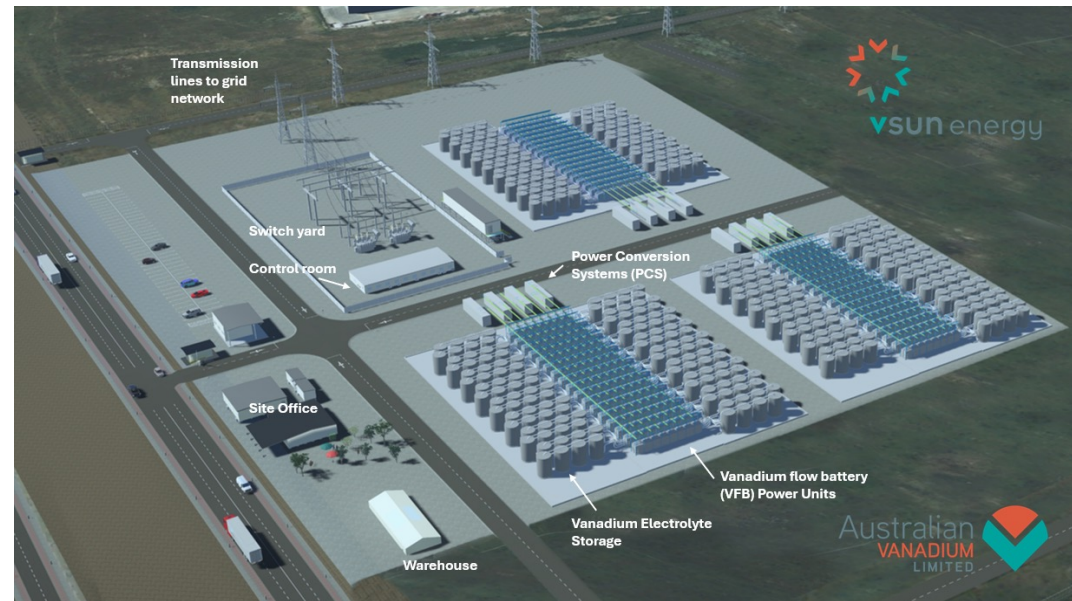
Source: Vanitec – [www.vanitec.org/latest-from-vanitec/category/news/](http://www.vanitec.org/latest-from-vanitec/category/news/)

## Project Lumina: Developing a utility scale vanadium flow battery

- Project Lumina<sup>1</sup> is the detailed design of a scalable, turnkey, utility-scale vanadium flow battery (VFB) designed for Australian conditions
- Following a deconstructed pathway removes electrolyte tanks and pumps from containers delivering material benefits including:
  - Rapid deployment
  - Ease of future duration extension
  - Materially lower construction capex
- Architecture:
  - Utilise proven cell stack technology (low technical risk)
  - Ability to use local components (pumps, pipes, tanks) to reduce costs, elevate local content and increase design flexibility and compliance with Australian Standards
  - Designed for +30year operational life
- Secured key technology provider and early contractor in
 




- Targeting detailed design for investment decision by Q3 CY2025

### Project Lumina - Rendering of 50MW VFB BESS

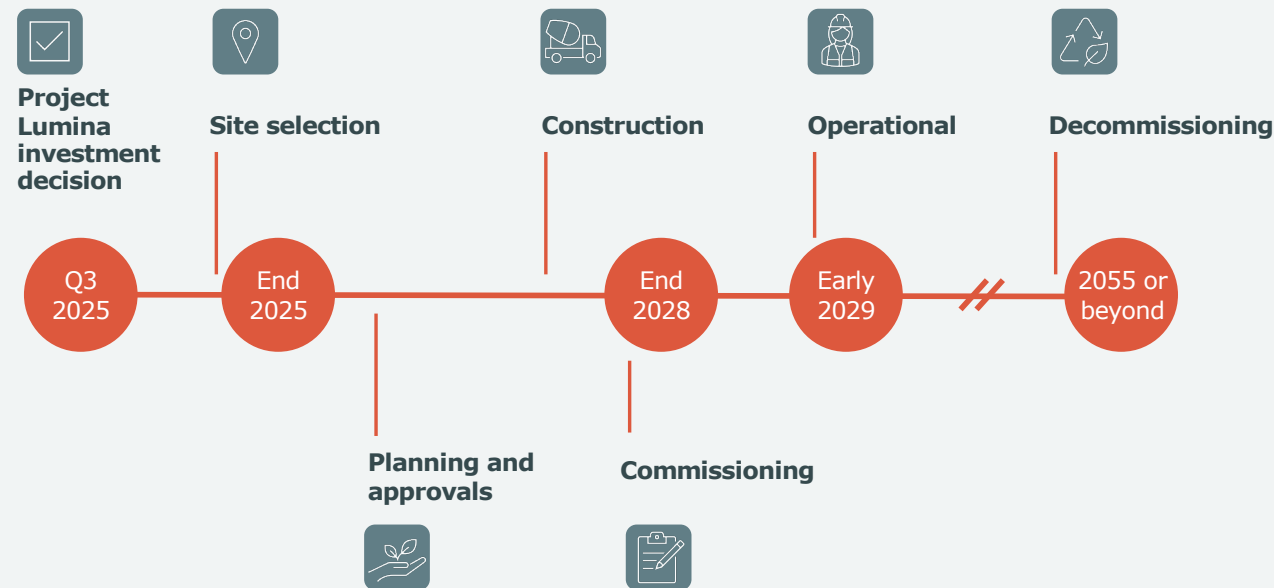


Notes:

1. Refer ASX announcement 6 November 2024, "Realising AVL's Utility-Scale Vanadium Flow Battery Strategy"

## Funding framework and development timeframe

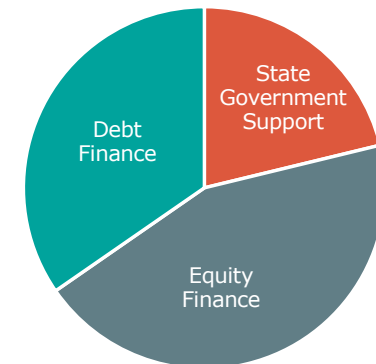
### Indicative project timeline:



### Funding example:

The Melbourne Renewable Energy Hub will be one of Australia's largest lithium BESS projects with an initial capacity of 600MW/1600MWh. Project capital is expected to cost \$1.2bn, supported by equity financing from the State Electricity Commission of Victoria

### Financing



Source: <https://infrastructurepipeline.org/project/melbourne-renewable-energy-hub-phase-1>

## Progressing towards investment decisions

### Delivered

- Bankable Feasibility Study (pre-merger basis)
- Mining Leases approved
- Completion of large-scale process plant pilot programs
- Australian Government grant agreement for up to \$49 million executed
- Merger to deliver project synergies
- Combined Mineral Resource estimate update
- Significant EPA approval received
- Green Energy Major Project status
- Establish electrolyte capability and deploy electrolyte into operational VFB BESS

### Next steps

#### Upstream Strategy – Australian Vanadium Project






- Publish integrated OFS
- Progress approvals including full EPA approval and Traditional Owner agreement
- Finalise permitting of proposed Tenindewa processing hub site
- Progress funding discussions including Government debt and export finance agencies
- Secure bankable offtake including option for project finance
- Deliver final investment decision

#### Downstream strategy – VSUN Energy

- Secure VFB BESS technology partners
- Secure priority locations for VFB BESS deployment
- Engage EPC/EPCM partners for battery deployment
- Progress funding discussions with potential strategic partners for rapid deployment of VSUN Energy strategy
- Secure energy offtake partners
- Progress Project Lumina to investment ready status
- Deliver investment decision on a VFB BESS project



## Investment highlights

 <p><b>Australia's grid continues to transition to renewables</b></p>	 <p><b>VFBs provide a proven, economic solution for utility scale energy storage</b></p>	 <p><b>Ability to capture downstream value</b></p>	 <p><b>Commercial partnerships in place</b></p>	 <p><b>World class Australian Vanadium Project</b></p>
<ul style="list-style-type: none"> <li>Increases the need for medium-to-long duration storage solutions capable of supporting the grid</li> <li>Growing government support for long duration storage in Australia</li> </ul>	<ul style="list-style-type: none"> <li>VFB rapid uptake into GWh scale energy storage systems</li> <li>Led by China, with over 20GWh of announced VFB projects</li> </ul>	<ul style="list-style-type: none"> <li>Competitive levelised cost of storage (LCOS) of VFBs as solution for high growth long duration energy storage market</li> <li>VFBs display operational advantages vs Li-ion</li> </ul>	<ul style="list-style-type: none"> <li>De-risked execution of Project Lumina</li> <li>AVL is well positioned to deliver investment ready utility scale VFB BESS solutions</li> </ul>	<ul style="list-style-type: none"> <li>Project provides supply chain scalability and security for VFBs</li> <li>Advancing toward investment decision - permitting, offtake, financing</li> </ul>

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# Appendix

## Upstream Grant funding and approvals support

- AVL was awarded a \$49 million grant under the Australian Government's Modern Manufacturing Initiative Collaboration Stream (**Grant**)
- The Grant enables AVL to pursue opportunities to minimise project execution risks through enhanced project definition, such as full detailed engineering of key infrastructure and project approvals
- AVL has received an initial two tranches of the Grant totalling \$24.5 million
- Continued progression of workstreams at the Australian Vanadium Project has the potential to unlock the remaining funds under the Grant
- AVL will continue to engage with State and Federal Agencies such as NAIF, ARENA, CEFC and National Reconstruction Fund Corporation to maximise utilisation of government and grant funding for the development of critical minerals and clean energy projects
- AVL recently secured EPA approval for the Gabanintha Vanadium Project which forms part of the Australian Vanadium Project
- AVL's Australian Vanadium Project recently secured Green Energy Major Project status from the WA Government
- Recent approval of the Critical Minerals Production Tax Incentive (CMPTI) can materially improve competitiveness of Australian based vanadium projects



## Midstream

### Proven vanadium electrolyte manufacturing capacity

#### AVL built, owns and operates a manufacturing facility in Perth, Western Australia, producing vanadium electrolyte

- 33MWh per annum energy storage equivalent of vanadium electrolyte production, with first production completed in 2024
- First use of AVL's vanadium electrolyte in an Invinity Energy Systems battery for WA utility Horizon Power
- Qualification of electrolyte well advanced with multiple VFB industry leaders
- Ability to scale and replicate facility to meet growing demand
- Ability to process third party vanadium oxides to supply high quality electrolyte prior to AVL oxide production



CEO Graham Arvidson and The Hon Anthony Albanese MP, Prime Minister of Australia, and The Hon Roger Cook MLA, Premier of Western Australia at AVL's electrolyte facility

# Downstream VSUN Energy – engaging with mining and utility customers

## IGO Limited



### Nova Nickel Operation (Western Australia)

Installation of a VFB to provide storage capacity to assist carbon free electricity to be used at the Nova Nickel operation, reducing their CO<sub>2</sub> emissions as part of IGO’s broader net-zero strategy.

**Status:** Battery operational, standalone power system under final stages of commissioning

## Horizon Power



### Kununurra (Western Australia)

Horizon Power, a utility owned by the Western Australia government, purchased a VFB installed at Kununurra as part of a long-duration energy storage pilot project. First battery to utilise AVL produced vanadium electrolyte.

**Status:** Commissioned and operational

# Policy settings: Growing support for long duration storage in Australia

## New South Wales – support for storage projects of at least 8 hours



### NSW powers ahead with biggest energy storage tender

[nsw.gov.au/media-releases/nsw-biggest-energy-storage-tender](https://nsw.gov.au/media-releases/nsw-biggest-energy-storage-tender)

Printed: 31 May 2024

Published: 31 May 2024

Released by: Minister for Energy and Climate Change

NSW has opened the largest energy storage tender in NSW history, seeking new long-duration storage projects to boost electricity reliability and keep the lights on in NSW.

These projects will help ensure a steady and reliable supply of energy around the clock. They will play a significant role in the NSW Government's transition to renewable energy, which will deliver reliable and affordable power to households and businesses at the same time as driving down emissions to meet our net zero targets.

Long-duration storage projects can bid for financial support under the new NSW Electricity Infrastructure Roadmap Tender 5 which is now open. This tender offers support for up to 1 gigawatt of projects, which can each release energy into the NSW grid for at least 8 hours.

## Western Australia – \$150M election commitment for 50MW/500MWh 10-hour VFB BESS

Roger Cook & WA Labor

**DOING WHAT'S RIGHT FOR WA**



**MEDIA RELEASE**

Thursday, 30 January 2025

### Australian-first battery project to reinforce Kalgoorlie's energy system

- Re-elected Cook Labor Government will invest \$150 million in WA-made vanadium battery
- Project will further reinforce Kalgoorlie's energy system and create around 150 jobs
- Cook Government has secured additional gas back-up generation for the Goldfields and is well underway with the process to replace West Kalgoorlie Power Station by 2026
- Project to stimulate WA's emerging vanadium industry and create opportunities for local battery manufacturing in Kalgoorlie

## Latest Federal Government support package targeted 4-hour projects



### The Capacity Investment Scheme


The Capacity Investment Scheme (CIS) Tender 3 – National Electricity Market (NEM) – Dispatchable (CIS Tender 3) Stage A has closed, and Project Bids are being assessed.


### About the Tender

Tender 3 is a competitive process to secure dispatchable capacity in the National Electricity Market (NEM).

The Tender is seeking an indicative target of 4 GW of four-hour equivalent dispatchable capacity, or 16 GWh of dispatchable capacity, that will be operational before 31 December 2029.



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